E/ECE/324
E/ECE/TRANS/505 } Rev.1/Add.32/Rev.1

12 October 1993

AGREEMENT

CONCERNING THE ADOPTION OF UNIFORM CONDITIONS OF APPROVAL AND RECIPROCAL RECOGNITION OF APPROVAL FOR MOTOR VEHICLE EQUIPMENT AND PARTS

done at Geneva on 20 March 1958

Addendum 32: Regulation No. 33

*Revision 1**

Incorporating:
Corrigendum 1** to the original text of the Regulation

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF VEHICLES WITH REGARD TO THE BEHAVIOUR OF THE STRUCTURE OF THE IMPACTED VEHICLE IN A HEAD-ON COLLISION

---

* Incorporating the amended procedure for determining the "H" point and the actual torso angle for seating positions in motor vehicles, referred to in documents TRANS/SC1/WP29/137, paragraphs 93 to 98 and TRANS/SC1/WP29/341, paragraph 77 and Annex 3, as well as general updating of the administrative provisions.

** Errata only.

UNITED NATIONS

Regulation No. 33

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF VEHICLES WITH REGARD TO THE BEHAVIOUR OF THE STRUCTURE OF THE IMPACTED VEHICLE IN A HEAD-ON COLLISION

CONTENTS

		Page
REGULATION		
1.	Scope	4
2.	Definitions	4
3.	Application for approval	5
4.	Approval	6
5.	Requirements	7
6.	Tests	8
7.	Modifications and extension of approval of the vehicle type	8
8.	Conformity of production	9
9.	Penalties for non-conformity of production	9
10.	Production definitely discontinued	9
11.	Names and addresses of technical services conducting approval tests, and of administrative departments	10
ANNEXES		
Annex 1	- Communication concerning the approval or extension or refusal or withdrawal of approval or production definitely discontinued of a vehicle type with regard to the behaviour of the structure of the passenger compartment in a head-on collision, pursuant to Regulation No. 33	11
Annex 2	- Arrangements of the approval mark	13
Annex 3	- Procedure for determining the "H" point and the actual torso angle for seating positions in motor vehicles	14
Annex 4	- Frontal-impact test against a barrier	26

Regulation No. 33

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF VEHICLES WITH REGARD TO THE BEHAVIOUR OF THE STRUCTURE OF THE IMPACTED VEHICLE IN A HEAD-ON COLLISION

1. SCOPE

This regulation applies to the behaviour of the structure of the passenger compartment of private (passenger) cars (other than forward-control vehicles) when subjected to a head-on collision.

2. DEFINITIONS

2.1. In defining the dimensions the following simplified terminology is used:

2.1.1. a "transverse plane" is a vertical plane perpendicular to the median longitudinal plane of the vehicle;

2.1.2. a "longitudinal plane" is a plane parallel to the median longitudinal plane of the vehicle;

2.1.3. the "vehicle's reference plane" is a plane related to the vehicle and horizontal when the vehicle in the state defined in paragraph 2.2.5. below rests on a horizontal plane.

2.2. For the purposes of this Regulation,

2.2.1. "approval of a vehicle" means the approval of a vehicle type with regard to the behaviour of the structure of the passenger compartment in a head-on collision;

2.2.2. "vehicle type" means a category of power-driven vehicles which do not differ in such essential respects as:

2.2.2.1. the length and width of the vehicle in so far as they have an effect on the results of the impact test prescribed in this Regulation;

2.2.2.2. the structure, dimensions, lines and materials of the part of the vehicle forward of the transverse plane through the "R" point of the driver's seat;

2.2.2.3. the lines and inside dimensions of the passenger compartment in so far as they have an effect on the results of the impact test prescribed in this Regulation;

2.2.2.4. the siting of the engine (front, rear or centre);

2.2.3. "forward-control vehicle" means a vehicle in which the centre of the steering wheel is in the forward quarter of the vehicle's total length (including bumpers and over-riders, if any);

2.2.4. "passenger compartment" means the space for occupant accommodation, bounded by the roof, floor, side walls, doors, outside glazing, front bulkhead, and the plane of the rear compartment bulkhead or the plane of the rear seat back support;

2.2.5. "unladen kerb weight" means the weight of the vehicle in running order, unoccupied and unladen but complete with fuel, coolant, lubricant, tools and a spare wheel (if provided as standard equipment by the vehicle manufacturer);

2.2.6. "capacity of the fuel tank" means the fuel-tank capacity as specified by the manufacturer.

3. APPLICATION FOR APPROVAL

3.1. The application for approval of a vehicle type with regard to the behaviour of the structure of the passenger compartment in a head-on collision shall be submitted by the vehicle manufacturer or by his duly accredited representative.

3.2. It shall be accompanied by the undermentioned documents in triplicate and by the following particulars:

3.2.1. a detailed description of the vehicle type with respect to its structure, dimensions, lines and constituent materials;

3.2.2. drawings of the vehicle showing the vehicle type in front, side and rear elevation and design details of the forward part of the structure, and

3.2.3. particulars of the vehicle's unladen kerb weight.

3.3. A vehicle representative of the type to be approved shall be submitted to the technical service responsible for conducting the approval tests.

3.3.1. A vehicle not comprising all the components proper to the type may be accepted for test provided that it can be shown that the absence of the components omitted has no detrimental effect on the results of the test, so far as the requirements of this Regulation are concerned.

3.3.2. It shall be the responsibility of the applicant for approval to show that acceptance of the variants referred to in paragraph 3.3.1. is compatible with compliance with the requirements of this Regulation.

4. APPROVAL

4.1. If the vehicle submitted for approval pursuant to this Regulation meets the requirements of paragraphs 5. and 6., below, approval of that vehicle type shall be granted.

4.2. An approval number shall be assigned to each type approved. Its first two digits (at present 00 for the Regulation in its original form) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party may not assign the same number to another vehicle type within the meaning of paragraph 2.2.2. above.

4.3. Notice of approval or of extension or of refusal or withdrawal of approval or production definitely discontinued of a vehicle type pursuant to this Regulation shall be communicated to the Parties to the Agreement which apply this Regulation by means of a form conforming to the model in annex 1 to this Regulation.

4.4. There shall be affixed, conspicuously and in a readily accessible place specified on the approval form, to every vehicle conforming to a vehicle type approved under this Regulation:

4.4.1. an international approval mark consisting of:

4.4.1.1. a circle surrounding the letter "E" followed by the distinguishing number of the country which has granted approval; 1/ and

4.4.1.2. the number of this Regulation, followed by the letter "R", a dash and the approval number to the right of the circle prescribed in paragraph 4.4.1.1.

1/ 1 for Germany, 2 for France, 3 for Italy, 4 for the Netherlands, 5 for Sweden, 6 for Belgium, 7 for Hungary, 8 for the Czech Republic, 9 for Spain, 10 for Yugoslavia, 11 for the United Kingdom, 12 for Austria, 13 for Luxembourg, 14 for Switzerland, 15 (vacant), 16 for Norway, 17 for Finland, 18 for Denmark, 19 for Romania, 20 for Poland, 21 for Portugal and 22 for the Russian Federation, 23 for Greece, 24, 25 (vacant) and 26 for Slovenia. Subsequent numbers shall be assigned to other countries in the chronological order in which they ratify or accede to the Agreement concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, and the numbers thus assigned shall be communicated by the Secretary-General of the United Nations to the Contracting Parties to the Agreement.

4.5. If the vehicle conforms to a vehicle type approved, under one or more other Regulations annexed to the Agreement, in the country which has granted approval under this Regulation, the symbol prescribed in paragraph 4.4.1.1. need not be repeated; in such a case the additional numbers and symbols of all the Regulations under which approval has been granted in the country which has granted approval under this Regulation shall be placed in vertical columns to the right of the symbol prescribed in paragraph 4.4.1.1.

4.6. The approval mark shall be clearly legible and be indelible.

4.7. The approval mark shall be placed close to or on the vehicle data plate affixed by the manufacturer.

4.8. Annex 2 to this Regulation gives examples of arrangements of the approval mark.

5. REQUIREMENTS

5.1. After the unladen vehicle without a manikin has been collision-tested forwards against a barrier at a speeed of 48.3 km/h, the interior space of the passenger compartment shall satisfy the requirements of paragraphs 5.2. to 5.9. below.

5.2. For each front seat as defined by the manufacturer the distance after impact shall be determined between two transverse planes, one passing through the corresponding "R" point and the other through the rearmost projection of the lines of the instrument panel (switches and controls being disregarded) over a width of 150 mm to each side of the longitudinal plane passing through the centre of the seat. This distance shall be not less than 450 mm.

5.3. Before impact, the straight line formed for each front seat by the intersection of the longitudinal plane passing through the centre of the seat with the horizontal plane passing through the centre of the service brake pedal in the position of rest shall be determined. The distance between the point of intersection of the said straight line with the front of the passenger compartment and its point of intersection with the transverse plane passing through the corresponding "R" point shall then be determined. After impact, this distance shall be not less than 650 mm.

5.4. The width of the footwell shall be determined as follows:

5.4.1. before impact, the points shall be determined at which a transverse horizontal axis passing through the centre of the service brake pedal in the position of rest meets the side walls of the footwell;

5.4.2. after impact, the distance separating two longitudinal vertical planes passing through the same points shall be measured. This distance shall be not less than 250 mm for each front seat.

5.5. The distance from floor to roof shall be determined along a vertical passing through the "R" point and situated in the longitudinal plane passing through the centre of each front seat. After impact, this distance shall not be reduced by more than 10%.

5.6. For measuring the distances referred to in paragraphs 5.2., 5.3., 5.4. and 5.5., compression corresponding to a force of 10 daN applied over a surface of 5 x 5 cm may be exerted in the direction of measurement.

5.7. After the test, no rigid component in the passenger compartment shall constitute a risk of serious injury to the vehicle's occupants.

5.8. In addition, the side doors of the vehicle shall not open under the effect of the impact.

5.9. Except in the case of a vehicle not having a roof of rigid construction, the opening of a number of doors sufficient to enable all the occupants to get out must be possible after the impact without the use of tools.

6. TESTS

The vehicle's compliance with the requirements of paragraph 5. above shall be checked by the methods set out in annexes 3 and 4 to this Regulation.

7. MODIFICATIONS AND EXTENSION OF APPROVAL OF THE VEHICLE TYPE

7.1. Every modification of the vehicle type shall be notified to the administrative department which approved the vehicle type. The department may then either:

7.1.1. consider that the modifications made are unlikely to have appreciable adverse effects, and that in any case the vehicle still meets the requirements; or

7.1.2. require a further test report from the technical service responsible for conducting the tests.

7.2. Without prejudice to the provisions of paragraph 7.1. above, a variant of the vehicle which meets the requirements of paragraph 3.3. of annex 4 to this Regulation, shall not be regarded as a modification of the vehicle type.

7.3. Confirmation or refusal of approval, specifying the alterations, shall be communicated by the procedure specified in paragraph 4.3. above to the Parties to the Agreement which apply this Regulation.

7.4. The competent authority issuing the extension of approval shall assign a series number for such an extension and inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in annex 1 to this Regulation.

8. CONFORMITY OF PRODUCTION

8.1. Every vehicle bearing an approval mark as prescribed under this Regulation shall conform to the vehicle type approved, more particularly as regards features affecting the behaviour of the structure of the passenger comparment in a head-on collision;

8.2. In order to verify conformity as prescribed in paragraph 8.1. above, a sufficient number of serially-produced vehicles bearing the approval mark required by this Regulation shall be subjected to random checks.

8.3. As a general rule, the checks aforesaid shall be confined to the taking of measurements. However, the vehicles shall if necessary be subjected to the checks prescribed in paragraph 6. above.

9. PENALTIES FOR NON-CONFORMITY OF PRODUCTION

9.1. The approval granted in respect of a vehicle type pursuant to this Regulation may be withdrawn if the requirement laid down in paragraph 8.1. above is not complied with or if the vehicle has failed to pass the tests provided for in paragraph 6. above.

9.2. If a Party to the Agreement which applies this Regulation withdraws an approval it has previously granted, it shall forthwith notify the other Parties to the Agreement which apply this Regulation thereof by means of a communication form conforming to the model in annex 1 to this Regulation.

10. PRODUCTION DEFINITELY DISCONTINUED

If the holder of the approval completely ceases to manufacture a vehicle type approved in accordance with this Regulation, he shall so inform the authority which granted the approval. Upon receiving the relevant communication that authority shall inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in annex 1 to this Regulation.

11. NAMES AND ADDRESSES OF TECHNICAL SERVICES CONDUCTING APPROVAL TESTS, AND OF ADMINISTRATIVE DEPARTMENTS

The Parties to the Agreement which apply this Regulation shall communicate to the Secretariat of the United Nations the names and addresses of the technical services conducting approval tests and of the administrative departments which grant approval and to which forms certifying approval or refusal or withdrawal of approval, issued in other countries, are to be sent.

Annex 1

COMMUNICATION

(maximum format: A4 (210 x 297))

issued by: Name of administration

.....

.....

.....

concerning: 2/ APPROVAL GRANTED
APPROVAL EXTENDED
APPROVAL REFUSED
APPROVAL WITHDRAWN
PRODUCTION DEFINITELY DISCONTINUED

of a vehicle type with regard to the behaviour of the structure of passenger compartment in head-on collision pursuant to Regulation No. 33

Approval No: ..... Extension No: .....

1. Trade name or mark of the vehicle .....

2. Vehicle type .....

3. Manufacturer's name and address .....

4. If applicable, name and address of manufacturer's representative .....

.....

5. Brief description of the vehicle type as regards its structure, dimensions, lines and constituent materials.....

6. Weight of vehicle when tested

front axle: .....

rear axle: .....

total: .....

7. Vehicle submitted for approval on .....

8. Technical service responsible for conducting approval tests.....

.....

9. Date of test report issued by that service .....

10. Number of test report issued by that service .....

11. Approval granted/extended/refused/withdrawn 2/

12. Position of approval mark on the vehicle .....

13. Place .....

14. Date .....

15. Signature .....

The list of documents deposited with the Administrative Service which has granted approval is annexed to this communication and may be obtained on request.

Notes

1/ Distinguishing number of the country which has granted/extended/refused/withdrawn/approval (see approval provisions in the Regulation).

2/ Strike out what does not apply.

Annex 2

ARRANGEMENTS OF THE APPROVAL MARK

Model A

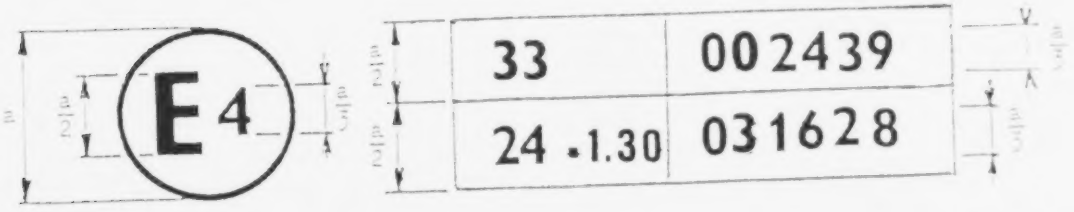
(See paragraphs 4.4. of this Regulation)

a = 8 mm min

The above approval mark affixed to a vehicle shows that the vehicle type concerned has, with regard to the behaviour of the structure of passenger compartment in head-on collision, been approved in the Netherlands (E4) under the number 032439. The first two digits of the approval number indicate that the approval was granted in accordance with the requirement of Regulation No. 33 in its original form.

Model B

(see paragraph 4.5. of this Regulation)



a = 8 mm min

The above approval mark affixed to a vehicle shows that the vehicle type concerned has been approved in the Netherlands (E4) pursuant to Regulations Nos. 33 and 24. 1/ (In the case of the latter Regulation the corrected absorption coefficient is 1.30 m^{-1}). The approval numbers indicate that on the dates on which these approvals were granted Regulation No. 33 had not yet been modified and Regulation No. 24 included the 03 series of amendments.

1/ The second number is given merely as an example.

Annex 3

PROCEDURE FOR DETERMINING THE "H" POINT AND THE ACTUAL TORSO ANGLE FOR SEATING POSITIONS IN MOTOR VEHICLES

1. PURPOSE

The procedure described in this annex is used to establish the "H" point location and the actual torso angle for one or several seating positions in a motor vehicle and to verify the relationship of measured data to design specifications given by the vehicle manufacturer. 1/

2. DEFINITIONS

For the purposes of this annex:

2.1. "Reference data" means one or several of the following characteristics of a seating position:

2.1.1. the "H" point and the "R" point and their relationship,

2.1.2. the actual torso angle and the design torso angle and their relationship.

2.2. "Three-dimensional 'H' point machine" (3-D H machine) means the device used for the determination of "H" points and actual torso angles. This device is described in appendix 1 to this annex;

2.3. "'H' point" means the pivot centre of the torso and the thigh of the 3-D H machine installed in the vehicle seat in accordance with paragraph 4 below. The "H" point is located in the centre of the centreline of the device which is between the "H" point sight buttons on either side of the 3-D H machine. The "H" point corresponds theoretically to the "R" point (for tolerances see paragraph 3.2.2. below). Once determined in accordance with the procedure described in paragraph 4, the "H" point is considered fixed in relation to the seat-cushion structure and to move with it when the seat is adjusted;

2.4. "'R' point" or "seating reference point" means a design point defined by the vehicle manufacturer for each seating position and established with respect to the three-dimensional reference system;

2.5. "Torso-line" means the centreline of the probe of the 3-D H machine with the probe in the fully rearward position;

2.6. "Actual torso angle" means the angle measured between a vertical line through the "H" point the torso line using the back angle quadrant on the 3-D H machine. The actual torso angle corresponds theoretically to the design torso angle (for tolerances see paragraph 3.2.2. below):

2.7. "Design torso angle" means the angle measured between a vertical line through the "R" point and the torso line in a position which corresponds to the design position of the seat-back established by the vehicle manufacturer;

2.8. "Centreplane of occupant" (C/LO) means the median plane of the 3-D H machine positioned in each designated seating position; it is represented by the coordinate of the "H" point on the "Y" axis. For individual seats, the centreplane of the seat coincides with the centreplane of the occupant. For other seats, the centreplane of the occupant is specified by the manufacturer;

2.9. "Three-dimensional reference system" means a system as described in appendix 2 to this annex;

2.10. "Fiducial marks" are physical points (holes, surfaces, marks or indentations) on the vehicle body as defined by the manufacturer;

2.11. "Vehicle measuring attitude" means the position of the vehicle as defined by the coordinates of fiducial marks in the three-dimensional reference system.

3. REQUIREMENTS

3.1. Data presentation

For each seating position where reference data are required in order to demonstrate compliance with the provisions of the present Regulation, all or an appropriate selection of the following data shall be presented in the form indicated in appendix 3 to this annex:

3.1.1. the coordinates of the "R" point relative to the three-dimensional reference system;

3.1.2. the design torso angle;

3.1.3. all indications necessary to adjust the seat (if it is adjustable) to the measuring position set out in paragraph 4.3. below.

3.2. Relationship between measured data and design specifications

3.2.1. The coordinates of the "H" point and the value of the actual torso angle obtained by the procedure set out in paragraph 4. below snall be compared, respectively, with the coordinates of the "R" point and the value of the design torso angle indicated by the vehicle manufacturer.

3.2.2. The relative positions of the "R" point and the "H" point and the relationship between the design torso angle and the actual torso angle shall be considered satisfactory for the seating position in question if the "H" point, as defined by its coordinates, lies within a square of 50 mm side length with horizontal and vertical sides whose diagonals intersect at the "R" point, and if the actual torso angle is within 5° of the design torso angle.

3.2.3. If these conditions are met, the "R" point and the design torso angle, shall be used to demonstrate compliance with the provisions of this Regulation.

3.2.4. If the "H" point or the actual torso angle does not satisfy the requirements of paragraph 3.2.2. above, the "H" point and the actual torso angle shall be determined twice more (three times in all). If the results of two of these three operations satisfy the requirements, the conditions of paragraph 3.2.3. above shall apply.

3.2.5. If the results of at least two of the three operations described in paragraph 3.2.4. above do not satisfy the requirements of paragraph 3.2.2. above, or if the verification cannot take place because the vehicle manufacturer has failed to supply information regarding the position of the "R" point or regarding the design torso angle, the centroid of the three measured points or the average of the three measured angles shall be used and be regarded as applicable in all cases where the "R" point or the design torso angle is referred to in this Regulation.

4. PROCEDURE FOR "H" POINT AND ACTUAL TORSO ANGLE DETERMINATION

4.1. The vehicle shall be preconditioned at the manufacturer's discretion, at a temperature of 20 ± 10° C to ensure that the seat material reached room temperature. If the seat to be checked has never been sat upon, a 70 to 80 kg person or device shall sit on the seat twice for one minute to flex the cushion and back. At the manufacturer's request, all seat assemblies shall remain unloaded for a minimum period of 30 min prior to installation of the 3-D H machine.

4.2. The vehicle shall be at the measuring attitude defined in paragraph 2.11. above.

4.3. The seat, if it is adjustable, shall be adjusted first to the rearmost normal driving or riding position, as indicated by the vehicle manufacturer, taking into consideration only the longitudinal adjustment of the seat, excluding seat travel used for purposes other than normal driving or riding positions. Where other modes of seat adjustment exist (vertical, angular, seat-back, etc.) these will then be adjusted to the position specified by the vehicle manufacturer. For suspension seats, the vertical position shall be rigidly fixed corresponding to a normal driving position as specified by the manufacturer.

4.4. The area of the seating position contacted by the 3-D H machine shall be covered by a muslin cotton, of sufficient size and appropriate texture, described as a plain cotton fabric having 18.9 threads per cm^2 and weighing 0.228 kg/m^2 or knitted or non-woven fabric having equivalent characteristics. If test is run on a seat outside the vehicle, the floor on which the seat is placed shall have the same essential characteristics 2/ as the floor of the vehicle in which the seat is intended to be used.

4.5. Place the seat and back assembly of the 3-D H machine so that the centreplane of the occupant (C/LO) coincides with the centreplane of the 3-D H machine. At the manufacturer's request, the 3-D H machine may be moved inboard with respect to the C/LO if the 3-D H machine is located so far outboard that the seat edge will not permit levelling of the 3-D H machine.

4.6. Attach the foot and lower leg assemblies to the seat pan assembly, either individually or by using the T-bar and lower leg assembly. A line through the "H" point sight buttons shall be parallel to the ground and perpendicular to the longitudinal centreplane of the seat.

4.7. Adjust the feet and leg positions of the 3-D H machine as follows:

4.7.1. Designated seating position: driver and outside front passenger

4.7.1.1. Both feet and leg assemblies shall be moved forward in such a way that the feet take up natural positions on the floor, between the operating pedals if necessary. Where possible the left foot shall be located approximately the same distance to the left of the centreplane of the 3-D H machine as the right foot is to the right. The spirit level verifying the transverse orientation of the 3-D H machine is brought to the horizontal by readjustment of the seat pan if necessary, or by adjusting the leg and foot assemblies towards the rear. The line passing through the "H" point sight buttons shall be maintained perpendicular to the longitudinal centreplane of the seat.

4.7.1.2. If the left leg cannot be kept parallel to the right leg and the left foot cannot be supported by the structure, move the left foot until it is supported. The alignment of the sight buttons shall be maintained.

4.7.2. Designated seating position: outboard rear

For rear seats or auxiliary seats, the legs are located as specified by the manufacturer. If the feet then rest on parts of the floor which are at different levels, the foot which first comes into contact with the front seat shall serve as a reference and the other foot shall be so arranged that the spirit level giving the transverse orientation of the seat of the device indicates the horizontal.

4.7.3. Other designated seating positions:

The general procedure indicated in paragraph 4.7.1. above shall be followed except that the feet shall be placed as specified by the vehicle manufacturer.

4.8. Apply lower leg and thigh weights and level the 3-D H machine.

4.9. Tilt the back pan forward against the forward stop and draw the 3-D H machine away from the seat-back using the T-bar. Reposition the 3-D H machine on the seat by one of the following methods:

4.9.1. If the 3-D H machine tends to slide rearward, use the following procedure. Allow the 3-D H machine to slide rearward until a forward horizontal restraining load on the T-bar is no longer required i.e. until the seat pan contacts the seat-back. If necessary, reposition the lower leg.

4.9.2. If the 3-D H machine does not tend to slide rearward, use the following procedure. Slide the 3-D H machine rearwards by applying a horizontal rearward load to the T-bar until the seat pan contacts the seat-back (see figure 2 of appendix 1 to this annex).

4.10. Apply a 100 ± 10 N load to the back and pan assembly of the 3-D H machine at the intersection of the hip angle quadrant and the T-bar housing. The direction of load application shall be maintained along a line passing by the above intersection to a point just above the thigh bar housing (see figure 2 of appendix 1 to this annex). Then carefully return the back pan to the seat-back. Care must be exercised throughout the remainder of the procedure to prevent 3-D H machine from sliding forward.

4.11. Install the right and left buttock weights and then, alternately, the eight torso weights. Maintain the 3-D H machine level.

4.12. Tilt the back pan forward to release the tension on the seat-back. Rock the 3-D H machine from side to side through 10° arc (5° to each side of the vertical centreplane) for three complete cycles to release any accumulated friction between the 3-D H machine and the seat.

During the rocking action, the T-bar of the 3-D H machine may tend to diverge from the specified horizontal and vertical alignment. The T-bar must therefore be restrained by applying an appropriate lateral load during the rocking motions. Care shall be exercised in holding the T-bar and rocking the 3-D H machine to ensure that no inadvertent exterior loads are applied in a vertical or fore and aft direction.

The feet of the 3-D H machine are not to be restrained or held during this step. If the feet change position, they should be allowed to remain in that attitude for the moment.

Carefully return the back pan to the seat-back and check the two spirit levels for zero position. If any movement of the feet has occurred during the rocking operation of the 3-D H machine, they must be repositioned as follows:

Alternately, lift each foot off the floor the minimum necessary amount until no additional foot movement is obtained. During this lifting, the feet are to be free to rotate; and no forward or lateral loads are to be applied. When each foot is placed back in the down position, the heel is to be in contact with the structure designed for this.

Check the lateral spirit level for zero position; if necessary, apply a lateral load to the top of the back pan sufficient to level the 3-D H machine's seat pan on the seat.

4.13. Holding the T-bar to prevent the 3-D H machine from sliding forward on the seat cushion, proceed as follows:

(a) return the back pan to the seat-back;

(b) alternately apply and release a horizontal rearward load, not to exceed 25 N, to the back angle bar at a height approximately at the centre of the torso weights until the hip angle quadrant indicates that a stable position has been reached after load release. Care shall be exercised to ensure that no exterior downward or lateral loads are applied to the 3-D H machine. If another level adjustment of the 3-D H machine is necessary, rotate the back pan forward, re-level, and repeat the procedure from paragraph 4.12.

4.14. Take all measurements:

4.14.1. The coordinates of the "H" point are measured with respect to the three-dimensional reference system.

4.14.2. The actual torso angle is read at the back angle quadrant of the 3-D H machine with the probe in its fully rearward position.

4.15. If a re-run of the installation of the 3-D H machine is desired, the seat assembly should remain unloaded for a minimum period of 30 min prior to the re-run. The 3-D H machine should not be left loaded on the seat assembly longer than the time required to perform the test.

4.16. If the seats in the same row can be regarded as similar (bench seat, identical seats, etc.) only one "H" point and one "actual torso angle" shall be determined for each row of seats, the 3-D H machine described in appendix 1 to this annex being seated in a place regarded as representative for the row. This place shall be:

4.16.1. in the case of the front row, the driver's seat;

4.16.2. in the case of the rear row or rows, an outer seat.

Notes

1/ In any seating position other than front seats where the "H" point cannot be determined using the "Three-dimensional 'H' point machine" or procedures, the "R" point indicated by the manufacturer may be taken as a reference at the discretion of the competent authority.

2/ Tilt angle, height difference with a seat mounting, surface txture, etc.

Annex 3 - Appendix 1

DESCRIPTION OF THE THREE-DIMENSIONAL "H" POINT MACHINE*

(3-D H machine)

1. Back and seat pans

The back and seat pans are constructed of reinforced plastic and metal; they simulate the human torso and thigh and are mechanically hinged at the "H" point. A quadrant is fastened to the probe hinged at the "H" point to measure the actual torso angle. An adjustable thigh bar, attached to the seat pan, establishes the thigh centreline and serves as a baseline for the hip angle quadrant.

2. Body and leg elements

Lower leg segments are connected to the seat pan assembly at the T-bar joining the knees, which is a lateral extension of the adjustable thigh bar. Quadrants are incorporated in the lower leg segments to measure knee angles. Shoe and foot assemblies are calibrated to measure the foot angle. Two spirit levels orient the device in space. Body element weights are placed at the corresponding centres of gravity to provide seat penetration equivalent to a 76 kg male. All joints of the 3-D H machine should be checked for free movement without encountering noticeable friction.

---

* For details of the construction of the 3-D H machine refer to Society of Automobile Engineers (SAE), 400 Commonwealth Drive, Warrendale, Pennsylvania 15096, United States of America.

The machine corresponds to that described in ISO Standard 6549-1980.

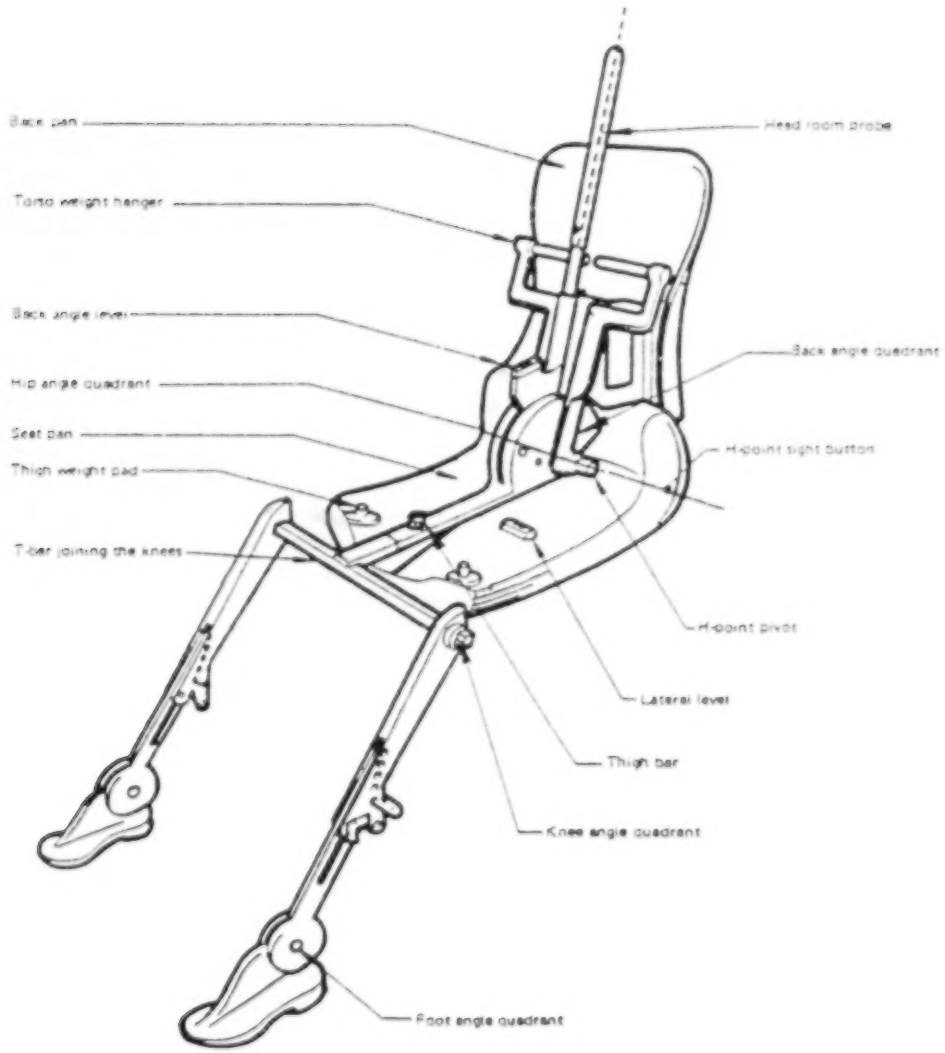


Figure 1 - 3-D H machine elements designation

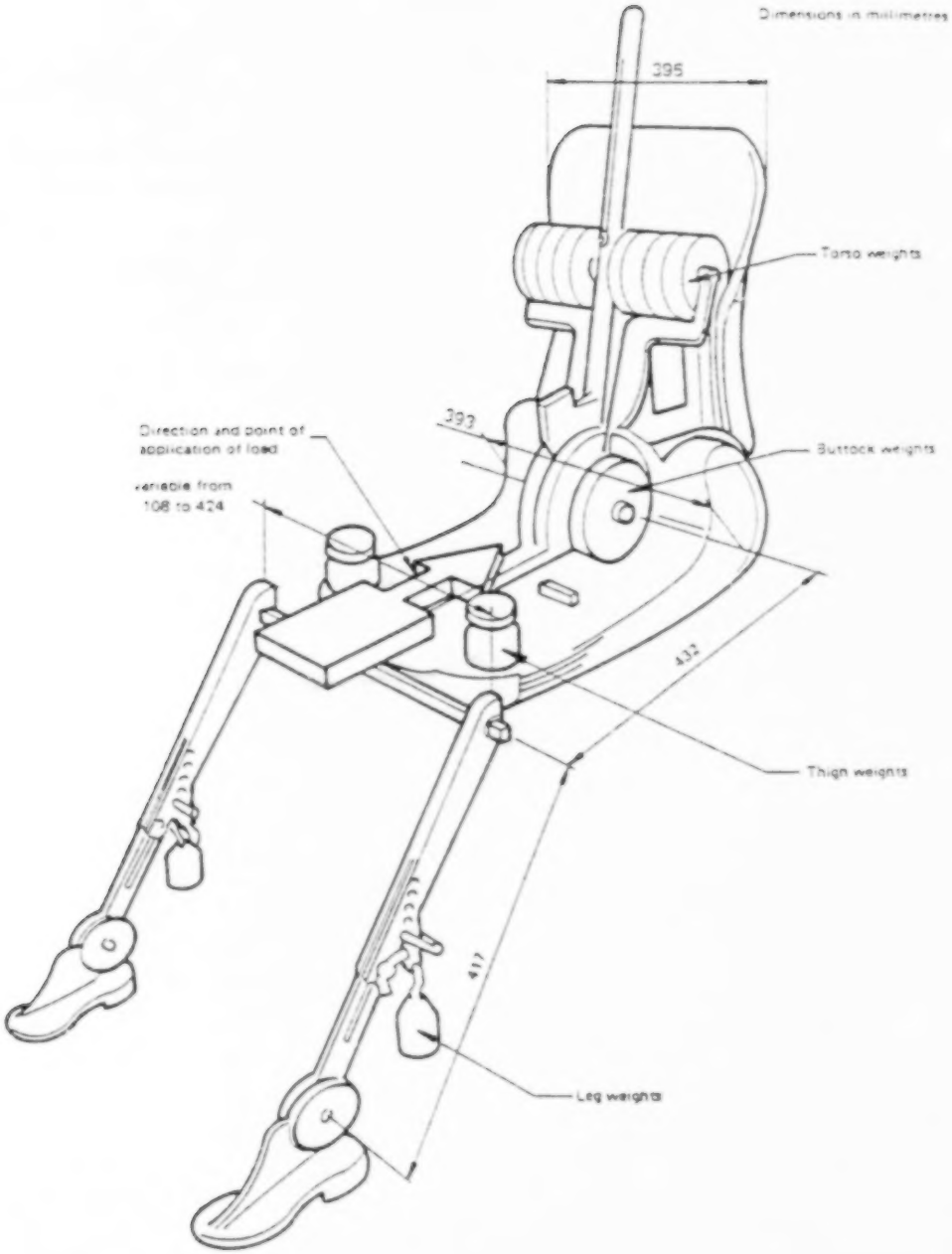


Figure 2 - Dimensions of the 3-D H machine elements and load distribution

Annex 3 - Appendix 2

THREE-DIMENSIONAL REFERENCE SYSTEM

1. The three-dimensional reference system is defined by three orthogonal planes established by the vehicle manufacturer (see figure).*

2. The vehicle measuring attitude is established by positioning the vehicle on the supporting surface such that the coordinates of the fiducial marks correspond to the values indicated by the manufacturer.

3. The coordinates of the "R" point and the "H" point are established in relation to the fiducial marks defined by the vehicle manufacturer.

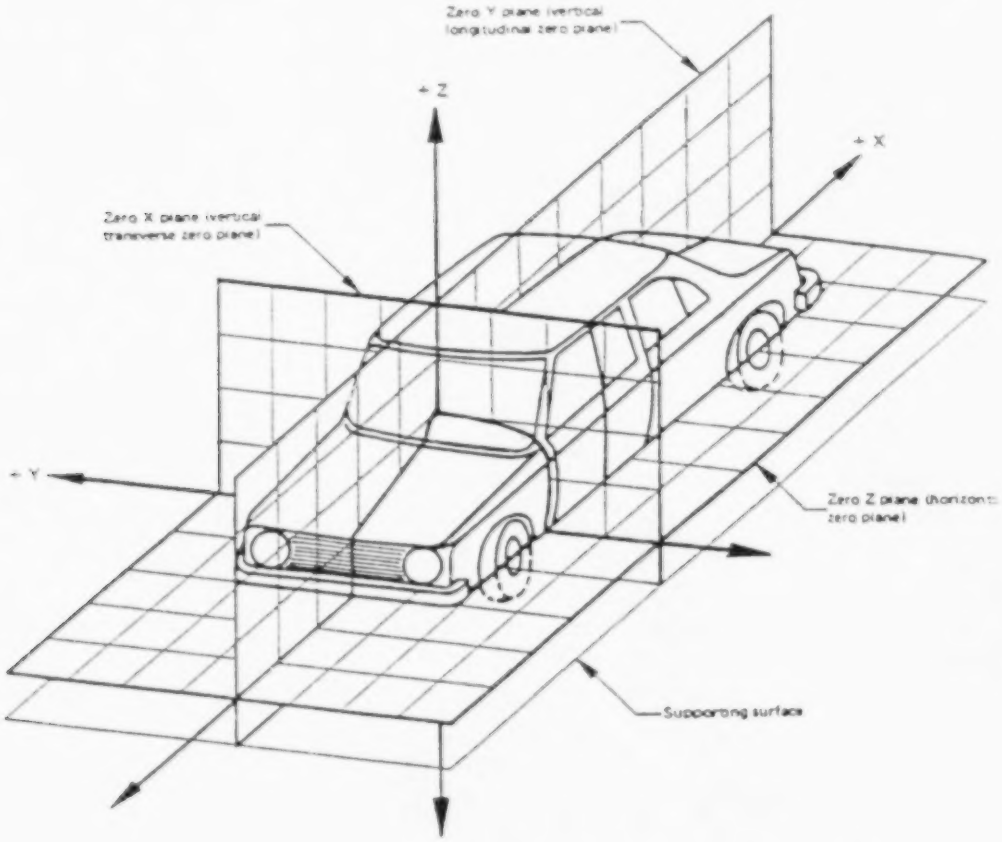

Zero Y plane (vertical longitudinal zero plane)
+ Z
+ X
Zero X plane (vertical transverse zero plane)
+ Y
Zero Z plane (horizontal zero plane)
Supporting surface

Figure - Three-dimensional reference system

---

* The reference system corresponds to ISO Standard 4130, 1978.

Annex 3 - Appendix 3

REFERENCE DATA CONCERNING SEATING POSITIONS

1. Coding of reference data

Reference data are listed consecutively for each seating position. Seating positions are identified by a two-digit code. The first digit is an Arabic numeral and designates the row of seats, counting from the front to the rear of the vehicle. The second digit is a capital letter which designates the location of the seating position in a row, as viewed in the direction of forward motion of the vehicle; the following letters shall be used:

L = left
C = centre
R = right

2. Description of vehicle measuring attitude

2.1. Coordinates of fiducial marks

X .....
Y .....
Z .....

3. List of reference data

3.1. Seating position: .....

3.1.1. Coordinates of "R" point

X .....
Y .....
Z .....

3.1.2. Design torso angle: .....

3.1.3. Specification for seat adjustment*

horizontal: .....
vertical: .....
angular: .....
torso angle: .....

Note: List reference data for further seating positions under 3.2., 3.3., etc.

---

* Strike out what does not apply.

Annex 4

FRONTAL-IMPACT TEST AGAINST A BARRIER*

1. INSTALLATIONS, PROCEDURE AND MEASURING INSTRUMENTS

1.1. Testing ground

The test area shall be large enough to accommodate the run-up track, barrier and technical installations necessary for the test. The last part of the track, for at least 5 m before the barrier, must be horizontal, flat and smooth.

1.2. Barrier

The barrier consists of a block of reinforced concrete not less than 3 m wide in front and not less than 1.5 m high. The barrier must be of such thickness that it weighs at least 70 tons. The front face must be vertical, perpendicular to the axis of the run-up track, and covered with plywood boards 2 cm thick in good condition. The barrier shall be either anchored in the ground or placed on the ground with, if necessary, additional arresting devices to limit its displacement. A barrier with different characteristics, but giving results at least equally conclusive, may likewise be used.

1.3. Propulsion of vehicle

At the moment of impact the vehicle must no longer be subject to the action of any additional steering or propelling device. It must reach the obstacle on a course perpendicular to the collision wall; the maximum lateral disalignment tolerated between the vertical median line of the front of the vehicle and the vertical median line of the collision wall is ± 30 cm.

1.4. State of vehicle

1.4.1. The vehicle under test must either be fitted with all the normal components and equipment included in its unladen kerb weight or be in such a condition as to fulfil this requirement so far as the components and equipment of concern to the passenger compartment and the distribution of the weight of the vehicle as a whole, in running order, are concerned.

---

* This method is not applicable to vehicles weighing more than 3.5 metric tons.

1.4.2. If the vehicle is driven by external means, the fuel installation must be filled to at least 90% of its capacity either with fuel or with a non-inflammable liquid having a density and a viscosity close to those of the fuel normally used. All other systems (brake-fluid header tanks, radiator, etc.) may be empty.

1.4.3. If the vehicle is driven by its own engine, the fuel tank must be at least 90% full. All other liquid-holding tanks may be filled to capacity.

1.4.4. If the manufacturer so requests, the technical service responsible for conducting the tests may allow the same vehicle as is used for tests prescribed by other Regulations (including tests capable of affecting its structure) to be used also for the tests prescribed by this Regulation.

1.5. Velocity on impact

The velocity on impact must be between 48.3 km/h and 53.1 km/h. However, if the test has been carried out at a higher impact velocity and the vehicle has satisfied the conditions prescribed, the test is considered satisfactory.

1.6. Measuring instruments

The instrument used to record the speed referred to in paragraph 1.5. above shall be accurate to within 1%.

2. RESULTS

Before and after impact, the dimensions specified in paragraph 5. of this Regulation shall be measured and recorded.

3. CORRECTION FACTORS

3.1. Notation

V Recorded speed in km/h;

m_0 Weight mass of prototype in state defined in paragraph 1.4. of this annex;

m Weight mass of prototype with testing apparatus;

D_0 Residual dimensions measured after the impact, as defined in paragraph 5. of this Regulation;

D_1 Corrected residual dimensions used to determine results of test;

K_1 = the greater of $(\frac{48.3}{v})^2$ and 0.83;

K_2 = the greater of $\frac{m_0}{m}$ and 0.8.

3.2. The corrected dimensions D_1 used to check the conformity of the prototype with the requirements of this Regulation shall be calculated by the following formula:

$$D_1 = D_0 . K_1 . K_2$$

3.3. A front impact test against a barrier is not needed in the case of a vehicle which is identical to the prototype considered as regards the characteristics specified in paragraph 2.2.2.1. of this Regulation but whose weight (mass) m_1 is greater than m_0, if m_1 is not more than 1.25 m_0 and if the corrected dimension D_2 obtained from the dimensions D_1 by the formula $D_2 = \frac{m_0}{m_1} . D_1$ are such as to show that the new vehicle still meets the requirements of paragraph 5. of this Regulation.

4. EQUIVALENT TEST METHODS

4.1. Equivalent test methods are permitted provided that the conditions referred to in this Regulation can be observed either entirely by means of the substitute test or by calculation from the results of the substitute test.

4.2. If a method other than that described in paragraph 1. above is used its equivalence must be demonstrated.